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FOR SETTLEMENT ONLY

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      Re: AES Puerto Rico L.P. – EPA Draft LEAF Testing Report

      We write on behalf of AES Puerto Rico, L.P. regarding EPA's draft report for Method 1313 and Method 1314 Leaching Environmental Assessment Framework ("LEAF") test results conducted on AGREMAX. *See* A.C. Garrabrants et al., *Leaching Behavior of "AGREMAX" Collected from a Coal-Fired Power Plant in Puerto Rico*, EPA-600/R-12/XXX (Nov. 2012) ("Report").

      From the outset, we reiterate AES Puerto Rico's objection to EPA Region 2's decision to evaluate AGREMAX using these LEAF test methods, rather than by EPA's long-validated analytical methods, such as the Toxic Characteristic Leaching Procedure (TCLP) and the Synthetic Precipitation Leaching Protocol (SPLP). The LEAF test methods are new and have not been used in either regulatory or enforcement contexts. Most importantly, there are no EPA guidelines for how to interpret or use the LEAF data that Region 2 has now collected. In effect, Region 2 is experimenting with this new test method in a potential enforcement context. These fundamental shortcomings are reflected in the serious flaws in the Report's technical analysis. The Report mischaracterizes and exaggerates the potential risks to human health posed by AGREMAX by using reference criteria selected by Region 2 enforcement staff that overstate the risks, and by presenting the test results in a biased format which raises unfounded concerns about AGREMAX. The basic flaws of the Report include:

-   <u>Fundamental misuse of the LEAF data.</u> According to a foundational article written by the developers of the LEAF methods—who are two of the authors of the EPA Report— the LEAF tests provide a range of data that must be considered in the context of actual real-world conditions. According to the authors, it was never the intent that the maximum constituent concentrations detected across all laboratory conditions would simply be compared to "environmental reference concentrations," without any attempt to determine whether any of the data are representative of "field leachate" from the real-

world conditions where the AGREMAX is being stored or has been used. Yet, that is precisely what EPA has done in this draft Report (*see* Table 4 of the Report).

- Improper selection of "environmental reference concentrations." Further, EPA did not use any scientific method when choosing the reference criteria against which it compared the LEAF results for assessing alleged health risks. Nor did it consider the real-world conditions in which AGREMAX is used or the pathways through which persons could theoretically be exposed. Rather, the only "principle" that Region 2 enforcement staff apparently provided to the Report's authors was to pick the lowest available reference concentrations. As a result, different constituents were evaluated against different criteria, including criteria that are not established by regulation or supported by peer reviewed data. Most notably, for many constituents, the Report ignores EPA's drinking water regulations (Maximum Contaminant Levels, or "MCLs") promulgated under the Safe Drinking Water Act, even though the EPA has asserted it is focused on the potential for AGREMAX to leach constituents to ground water that would be used for drinking water purposes.

- Use of maximum concentrations from the Method 1313 testing that do not occur under realistic AGREMAX application scenarios and could not even theoretically occur for tens of thousands of years. EPA used a flawed process for selecting the Method 1313 data it compared to the reference concentrations. The Report arbitrarily chose the maximum concentrations of each metal detected when the pulverized aggregate solution was within a pH range of 6.5 to 11.5, without any consideration as to whether that pH range actually reflects the pH of AGREMAX in the environment. In fact, the LEAF test results themselves suggest that leachate from AGREMAX with a pH below 10 will *not* occur in the environment under any realistic conditions; instead, AGREMAX's typical pH will likely remain between 10 and 11. Specifically:

  o The pH of AGREMAX observed in Method 1314 stayed consistently between 10 and 11 even at the higher liquid-to-solid ratios, which are supposed to reflect long-term conditions.

  o In order to produce an AGREMAX solution with an 8.6 pH (the next lowest pH observed below 10), EPA had to add a highly acidic solution of nitric acid with a pH of approximately 0.6. That will never happen in the environment, as pH 0.6 is orders of magnitude more acidic than the rain in Puerto Rico.

  o Conversely, if we instead assume that rainwater with the actual pH of rainfall in Puerto Rico were to infiltrate AGREMAX, the resulting solution would still be in the pH range of 10-11 for millennia to come. In fact, the data indicate that, even with a series of conservative assumptions, it would take over *50,000 years of*

rainfall before the pH of leachate from AGREMAX placed in the environment in Puerto Rico could reach a pH of 8.6—and even longer to reach the lower pH values relied on by EPA in its Report.

Hence, by compiling maximum values from an unrealistic pH range and comparing them to equally unrealistic reference criteria, the Report presents an unrealistic set of results that provide no sound or supported basis to assess actual risks to human health or the environment.

- Improper use of Method 1314 data. The Report likewise erroneously focuses on the maximum concentration detected from the 1314 data, without considering whether that single data point squares with reality. Under Method 1314, increasing volumes of deionized water are passed through a column of pulverized AGREMAX. The water is collected and tested, resulting in a data set based on a range of "Liquid to Solid" ("L/S") ratios. By always choosing the single maximum data point, the Report invariably considered only the *lowest* L/S ratios. Yet, if one were to use Method 1314 to evaluate how AGREMAX may actually perform in the real world over the long term, one should assess the 1314 data from the *highest* L/S ratio, as those data would more closely approximate what may leach from AGREMAX over time as more liquid (rainfall) reaches the material. Using data that might more closely mirror how AGREMAX may react over the long term would also be more consistent with the assumption of long term, daily exposure that EPA uses when it sets environmental standards. Using the proper L/S ratio, no significant risks to human health are observed.

- Grossly misleading presentation of the data. By presenting data in a format with red and yellow boxes, the Report gives the misimpression that AGREMAX may pose risks to human health merely because concentrations of certain constituents exceed a screening level in laboratory tests. In reality, the Report makes no attempt to account for the dilution and attenuation processes that EPA has acknowledged would substantially reduce any concentrations of constituents that might reach ground water, much less potential receptors. Moreover, despite its colored boxes, the Report is not a risk assessment, in that it makes no attempt to assess what risk AGREMAX may actually present to human health in the environment at any locations where it has been used.

Finally, although we do no agree that the LEAF test should be used in this context at all,[1] mirroring the format used by EPA, we have prepared tables that compare a more reasonable

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[1] If EPA is going to use the novel LEAF methods, we question why EPA has not also tested a solid aggregate material such as AGREMAX using LEAF Method 1315. Methods 1313 and 1314 both entail pulverizing the aggregate before conducting the test. In contrast, Method 1315 tests leaching from a solid "monolithic or compacted granular material," more akin to an aggregate material. EPA, Background Information for Leaching Environmental

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selection of detected concentrations from the Method 1313 and 1314 tests, against more appropriate reference concentrations. *See* Exhibit 1 and Exhibit 2. As the attached tables show, no concentrations of constituents exceed the screening levels in amounts that would give rise to any concerns worthy of action by EPA, including under RCRA § 7003.

In sum, given the fundamental flaws associated with this draft Report, any EPA enforcement action that is based on the draft Report would be arbitrary and capricious, an abuse of discretion, and contrary to law. We look forward to discussing these results with EPA and hearing how EPA would address these serious flaws, before the agency takes any action.

I.   **LEAF Test Results Should Not Be Used By EPA For the First Time in An Enforcement Effort, Particularly When EPA Has Not Calibrated the Results to Actual Field Conditions Or Published Guidance on How to Interpret LEAF Data**

As an initial matter, we urge the agency to reconsider the unprecedented use of the results of LEAF testing to support an EPA enforcement effort. Although EPA has recently included LEAF Method 1313 (but not Method 1314) as "guidance" in SW-846,[2] to our knowledge, EPA has never before used LEAF testing for any previous regulatory or enforcement action.[3] To insert the Agency's first use of the LEAF Methods into an enforcement context is improper— especially when the materials have not been shown to be hazardous or present a risk to human health or the environment under EPA's established test methods.

Further, EPA should not be using the LEAF test results in an enforcement context because EPA has not published any guidance on how to fairly and properly interpret the laboratory data that may be generated by these brand new methods.[4] EPA has not, for example, calibrated LEAF test results to field data for coal-combustion products, particularly CCPs produced by a circulating fluidized bed combustion process like AGREMAX. This calibration process is critical to understanding the reams of data compiled in the Report because the LEAF test takes place in an artificial laboratory environment that does not encompass important geochemical dynamics in real-world conditions.[5] Without this calibration, EPA does not know

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Assessment Framework (LEAF) Test Methods, at 25, EPA/600/R-10/170 (Nov. 2010), available at http://www.vanderbilt.edu/leaching/downloads/publications/leaf-supporting-documentation.

[2] EPA, New Test Methods On-Line, available at http://www.epa.gov/osw/hazard/testmethods/sw846/new_meth.htm.

[3] We have repeatedly asked EPA staff for any instances where LEAF has been so used, but none has been identified.

[4] Indeed, the flaws from applying these methods that are highlighted in this letter underscore the need not only for guidance, but that EPA make the guidance available to the public for notice and comment to allow stakeholders to vet fully any guidelines EPA would propose.

[5] This is a generally accepted principle applicable to any laboratory test method. Moreover, the authors of the LEAF protocol have long acknowledged the need for test conditions to match field conditions. *See* discussion, *infra.* EPA has also acknowledged that the "relationships between eluate concentrations observed from this method [1313] and

to what extent the LEAF test results approximate constituent concentrations from actual leachate obtained from the field. Confirming the need for such calibration, one set of comparisons conducted by the Electric Power Research Institute suggest that the LEAF protocols may produce maximum concentrations that exceed maximum concentrations found in the field by nearly a factor of *ten* for certain constituents, including arsenic and selenium, two of the constituents on which the Report focuses. These variations would undermine any enforcement action based on the LEAF results, for "[a]n agency's use of a model is arbitrary if that model 'bears no rational relationship to the reality it purports to represent.'" *Columbia Falls Aluminum Co. v. EPA*, 139 F.3d 914, 923 (D.C. Cir. 1998) (granting petition challenging EPA's use of TCLP data to justify a treatment standard when tests of "real leachate" were different from results in TCLP tests).

The absence of regulatory guidance on how to interpret LEAF test results means the results may be incorrectly used—just as they are in the Report. In the Report, EPA has "cherry picked" the maximum data points from a wide range of both the Method 1313 and 1314 results, and then compared those individual data points to "reference concentrations" that EPA enforcement has chosen. Yet, the differences among the conditions theoretically simulated by these laboratory test methods are substantial. Consider pH, for example. The pH scale is *logarithmic* and as a result, each whole pH value below 7 is ten times more acidic than the next higher value, while each pH value above 7 is ten times more alkaline than the previous value. As such, even within the range of data used by EPA (a pH range of 6.5 to 11.5), the highest assumed leachate pH is about 100,000 times more alkaline than the lowest assumed pH, without any evidence that such a range actually exists or would ever exist in the environment in which AGREMAX is used. EPA makes its comparisons to reference concentrations without a documented analysis or other consideration of actual field conditions for pH (or the L/S ratios).

To make these comparisons without considering field conditions is directly contrary to the approach contemplated for LEAF. In an article written about LEAF, two of the authors of EPA's Report (Kosson and Garrabrants) stated that they created the LEAF test protocols as an alternative to a "concentration-based approach" that compares a concentration detected by a single-batch test against a reference concentration below which no significant impact to groundwater is anticipated, without regard for the actual field conditions. *See* Kosson, D.S., H.A. van der Sloot, F. Sanchez & A.C. Garrabrants, *An Integrated Framework for Evaluating Leaching in Waste Management and Utilization of Secondary Materials*, 19 Environmental Engineering Science 159, 165 (2002).[6] According to Kosson and Garrabrants, "this approach

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field leachate *must be considered* in the context of the material being tested and the field scenario being evaluated." EPA, SW-846 Update V, Revision 0, § 1.6 (Oct. 2012) (emphasis added), available at http://www.epa.gov/osw/hazard/testmethods/sw846/pdfs/1313.pdf.

[6] *See also* EPA, Proposed Rule, Disposal of Coal Combustion Residues from Electric Utilities, 75 Fed. Reg. 35128, 35139 (June 21, 2010) (explaining that the LEAF methods were developed in response to concerns that "single-point pH tests" may not reflect the range of "actual conditions under which wastes are plausibly managed").

can be misleading if the test conditions do not reasonably reflect the field conditions (e.g., with respect to pH and LS ratio)." *Id.* (emphasis added). The LEAF test allows a user to create data on constituent concentrations across a wide range of theoretical pH levels and L/S ratios. However, merely creating such a range of data under laboratory conditions does not mean all of those data are useful to evaluating risks in the environment. Rather, the asserted goal of the authors was to allow users to select the appropriate conditions, and hence identify the data that would most closely approximate the particular material and site at issue for additional modeling. Thus, simply picking the highest detected concentrations from results across a wide range of pH levels and L/S ratios without any effort to evaluate whether that range or ratio reflects actual field conditions, and then comparing that single data point to a reference criteria, is a gross misuse of the LEAF testing data.[7]

II. The Report Selects Improper Reference Criteria

A second major failure of the Report is the choice of "environmental reference" criteria against which the LEAF data were compared to determine if AGREMAX may present a risk to drinking water. The Report states that EPA Region 2 enforcement staff requested that the LEAF test results be compared to the lower of EPA Region 9 regional screening levels (RSLs) or EPA's drinking water equivalent levels (DWELs), allegedly "[i]n order to place leaching test results into context." Report at 5-6.

The Report's reliance on the Regional staff's chosen references is inappropriate and the assertion about placing the data "in context" is conclusory. Indeed, the Report does not provide any rational principle in choosing between or among the MCL, RSL, or DWEL for any particular constituent. Rather, the only guiding principle EPA used was to pick the lowest concentration for each constituent, regardless of its scientific validity, regulatory status, or whether it is appropriate for any of the locations where AGREMAX has been (or may be) placed. Thus, while the Report purports to prefer RSLs over MCLs for certain constituents (Report at 6, n.3), it then abandons the RSL when the MCL happens to be lower (*e.g.*, barium). The Report likewise abandons the RSL in favor of the DWEL when the DWEL happens to be lower, even though the

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[7] EPA's misuse of the data is exactly the concern that EPRI raised in its comments to EPA.

> Our primary concerns with the LEAF protocol are inappropriate use of the large volume of data generated, and the lack of field validation to help guide application of the data. Both of these issues are discussed in the sections below. The LEAF protocol generates data simulating a range in environmental conditions (pH 2 to 12, L/S ratio <1 to 20), so simply picking the highest concentration among the dataset and comparing it to a regulatory limit (e.g., MCL or TC Limit) is not technically valid. Analysis procedures and tools are needed to interpret and apply the data properly. Development of these procedures and tools is underway, but they are not as advanced as the laboratory procedures. As a result, reported laboratory data can be, and frequently are, taken out of context.

EPRI Comments, *supra* at 58.

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DWELs clearly have no relevance.[8] This arbitrary mixing-and-matching cannot result in reasoned decision-making.

Rather, if these LEAF data are to be compared to reference criteria to evaluate whether there is a possible risk to human health (and we submit the LEAF testing should not be used at all for that purpose) they should, at most, be compared to promulgated Safe Drinking Water Act standards *after* an appropriate dilution and attenuation factor has been applied. The Region's premise for conducting the LEAF testing was to evaluate the potential for certain constituents to leach from AGREMAX and reach groundwater that may become a source of drinking water. *See* Report at 6-7, 13. Logically, then, after considering dilution and attenuation, the appropriate reference criteria should be the MCLs, which are the nationally enforceable drinking water standards, adopted through rigorous scientific review and notice-and-comment rulemaking. Those are the standards by which tap water everywhere in the United States is judged, including in Puerto Rico. By contrast, the RSLs and DWELs are only guidance, developed without the review process afforded an MCL and used for entirely different purposes, such as, in the case of the RSLs, as a highly conservative, first-step *screen* to assess Superfund sites.[9] Of course, even the MCL is not a directly relevant reference criteria, because the LEAF test results are not

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[8] As EPA guidance explains, a DWEL makes the unrealistic assumption that a person drinks 100% of his or her water from this one source over his or her entire lifetime. EPA, *2012 Edition of the Drinking Water Standards and Health Advisories*, vi (Spring 2012), available at http://water.epa.gov/action/advisories/drinking/upload/dwstandards2012.pdf.

[9] *See e.g.,* RSL User's Guide (November 2012), available at http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm (RSLs are initial screening levels).

At one point, the Report seeks to justify preferring RSLs by noting that RSLs are based on an estimated excess cancer risk of 1 in 1 million, whereas MCLs take feasibility into account and reflect an estimated excess cancer risk of 1 in 10,000. Report at 6 n.3. But this ignores that RSLs are an extremely conservative generic screen in evaluating Superfund sites to determine if a further risk assessment might be necessary. EPA's actual target risk range—within which no further clean-up action is required—begins at an excess cancer risk of 1 in 10,000, which EPA considers sufficiently protective of human health. See EPA, Memorandum from Don R. Clay, *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*, OSWER Directive 9355.0-30 (Apr. 22, 1991). Thus, an RSL could be increased by *two orders of magnitude* and still be acceptably within EPA's target risk range.

The Report also contends that MCLs "may not reflect the very latest science" and are "not updated as easily or frequently as RSLs." Report 6 n.3. By this argument, EPA seems to be arguing that RSLs are more accurate assessments of risk than are the MCLs. That is incorrect. Whereas the MCLs undergo thorough scientific and public regulatory review, the RSLs may be based on less comprehensive scientific data—even, in some cases, a single study. *See e.g.,* discussion *infra* regarding Thallium. Nor do RSLs undergo the scrutiny of a public comment process demanded for an MCL. Indeed, as detailed below, certain of the RSLs selected in the Report are highly suspect and not appropriate for use in the context of AGREMAX use in Puerto Rico. In any event, the fact remains that MCLs are the approved standard for tap water anywhere in the United States. It is illogical to impose one standard on the water people consume every day, but use an entirely different and more stringent standard for buried material to which no person may ever be exposed.

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measuring constituents in drinking water. Rather, the results reflect constituents in liquid in direct contact with AGREMAX, which no one is drinking.

III. The Report Fails to Account for Adsorption, Attenuation, and Dilution That Would Occur Before Any Possible Exposure

A further critical failure of the Report—a failing expressly acknowledged—is that in presenting the data, the Report does not take into account real world factors such as adsorption, attenuation, and dilution between the theoretical point of "release" and any point of exposure. Report at 11. Those real world factors would greatly reduce the amount of any constituents leaching from AGREMAX that could theoretically reach a drinking water receptor. (No such nexus has been shown.) Rather, the Report only compiles the concentrations of constituents in a laboratory solution that came directly into contact with AGREMAX.

Those LEAF-reported concentrations are clearly not the concentrations that would be present in ground water, let alone a hypothetical well (none are identified by EPA) downgradient of an area where AGREMAX has been placed. Indeed, as EPA expressly acknowledged in its 2010 proposal regarding CCPs, well recognized adsorption, attenuation, and dilution processes would "invariably" reduce the concentration of constituents before any constituent might theoretically reach the underlying ground water.[10] The infiltrating water would have to percolate through or around the AGREMAX, and then percolate downward through the underlying soil until it reaches the water table. These processes are typically slow, and the interaction of the water with the soil during percolation will result in a decrease in concentration (as some material "adsorbs" to the soil) as water infiltrates through the soil column. Once percolating water reaches the underlying groundwater, it will mix with the groundwater and then travel with it, which also tends to decrease (or attenuate) concentrations. As a result of all these processes, the concentrations of constituents will be substantially reduced before they reach a theoretical drinking water source. For that reason, EPA's 2010 proposal regarding CCPs urges "caution" before comparing LEAF-reported concentrations to "regulatory health values," and warns that additional, site-specific "[g]roundwater transport and fate modeling would be needed to generate an assessment of the likely risk that may result" from any particular CCPs. *See* EPA, Proposed Rule, Disposal of Coal Combustion Residues from Electric Utilities, 75 Fed. Reg. 35128, 35140 (June 21, 2010).

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[10] *See, e.g.*, EPA, Proposed Rule, Disposal of Coal Combustion Residues from Electric Utilities, 75 Fed. Reg. 35128, 35140 (June 21, 2010). These are well understood factors that EPA has long recognized would have to be considered based on available data before determining whether and if so at what levels there is a risk that drinking water could be impacted by the presence of a substance in soil. *See id.*; *see also, e.g.*, EPA, Soil Screening Guidance: User's Guide at 29 (July 1996) (identifying factors), available at http://www.epa.gov/superfund/health/conmedia/soil/pdfs/ssg496.pdf.

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Yet, the Report does not consider at all the actual effect of these processes which EPA's 2010 proposal considered "critical to bear in mind." *Id.* By contrast, in other contexts, EPA has adopted dilution-attenuation factors to account for these processes. For example, EPA used a dilution-attenuation value of 100 in the Toxicity Characteristic final regulation. *See* 55 Fed. Reg. 11827 (Mar. 29, 1990).[11] And for screening soil in Superfund clean-ups, EPA has adopted a standard dilution-attenuation factor of 20. *See* EPA, *Soil Screening Guidance Technical Background Document* Part 2, at 46. Using these more conservative EPA analyses, the attenuation and dilution processes would be assumed to reduce the constituent concentrations by factors of 20 or 100 before reaching any theoretical receptors. To the extent the Report has factored in attenuation and dilution processes, it highlights constituents with a yellow box when the EPA-selected maximum data point has a concentration just 10 times greater than the EPA reference screening concentration (what the Report calls an "indicator ratio.") The Report uses this factor of 10 without explaining why it is an appropriate metric, as opposed to the significantly higher factors that EPA has used elsewhere.

IV. The Report Distorts the Method 1313 Results by Selecting the Maximum Detected Concentration Across an Unrealistic Range of pH Levels

Compounding the above errors, the Report compares the reference concentrations to maximum data points produced in the laboratory that do not reflect actual, real world conditions. Instead, when comparing the Method 1313 leaching results to the reference criteria, the Report arbitrarily used a data set composed of the highest concentrations for each constituent detected when the solution of pulverized AGREMAX was within a pH range of 6.5 to 11.5. *See* Report at 11-12. Yet, the Report selected this pH range without citing or providing *any* technical reasoning, field data or other scientific support of any kind for why the range EPA chose is applicable to the use of AGREMAX in the environment. That is the essence of arbitrary and capricious action by an agency, which it compounded by disclosing this flawed *draft* report to the public.[12]

Even beyond this, EPA's approach has two basic flaws.

A. The broad range of pH values used in Table 4 of the Report are unrealistic

First, the broad range of pH values considered by the Report (6.5 to 11.5) could not possibly occur in the real world. The Report itself indicates that a pH range of 10–11, rather than 6.5–11.5, is more likely to approximate real world conditions. Specifically, the Method 1314

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[11] *See also* EPA, Proposed Rule, Disposal of Coal Combustion Residues from Electric Utilities, 75 Fed. Reg. 35128, 35140 n.18 (June 21, 2010) (noting this generic dilution-attenuation factor value of 100).

[12] The Region advised AES Puerto Rico that the Report was released in response to a FOIA request.

results, which are supposedly designed to approximate different durations of exposure,[13] clearly demonstrate that AGREMAX is highly alkaline and its leachate maintains a pH in the range of 10 to 11 over the range of L/S ratios. Report, at 8; *see also* Report, at A-1 (graphical representation of leachate pH levels for Method 1314).

The Method 1313 results further confirm that a pH range of 10-11 best matches expected field conditions. Method 1313 requires the laboratory to add liquid of varying pH to AGREMAX in order to produce a solution of leachate at targeted pH levels. *See* Report, at 2-3. The Method 1313 results indicate that the pH of the leachate that results from mixing neutral water (pH 7) with AGREMAX is 10.9. *See* Report 3 n.1, 8. That result is far more representative of field conditions than the lower pH levels of AGREMAX leachate that the Report analyzes. The reason for this is simple: to produce a solution of AGREMAX at the lower targeted pH levels, EPA had to add a highly acidic nitric acid solution to which AGREMAX would never be exposed in the environment. For example, to achieve an AGREMAX leachate at the next lower pH of 8.6, the laboratory had to add 50 mL of 2.0 Normal nitric acid—with an extremely low pH of essentially zero—along with 327 mL of neutral water. This means the pH of the liquid being added to the AGREMAX was approximately 0.6—many orders of magnitude lower than the average pH of rainfall in the region, which is approximately 5.0.[14] In fact, the pH of the added liquid is more than *10,000 times* more acidic than rainfall in Puerto Rico. Clearly, unless a truckload of highly acidic nitric acid is dumped directly on an uncovered application of AGREMAX, no liquid at such a low pH would ever contact AGREMAX. Thus, the Method 1313 test results at the leachate pH levels below 10.9 should not be considered.[15]

Another illustration, based on actual conditions in southern Puerto Rico, confirms that LEAF test results at the lower pH levels are irrelevant. The EPA Method 1313 LeachXS spreadsheet indicates how much nitric acid per gram of AGREMAX is required to achieve given leach pH levels in the leaching test. By making conservative, generic assumptions about a typical site in which AGREMAX may be beneficially used in southern Puerto Rico, we can use readily available data to calculate how much rainfall would be required to achieve that same

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[13] EPA, Background Information for the Leaching Environmental Assessment Framework (LEAF) Testing Methods, EPA/600/R-10/170, at 7-8 (Nov. 2010).

[14] *See* Elba D. Osborne, Engineering Research Center, University of Puerto Rico, *Acid Rain in Puerto Rico, Final Technical Report to the US Dept of the Interior* (1986); National Atmospheric Deposition Program, available at http://nadp.sws.uiuc.edu.

[15] Likewise, to achieve an AGREMAX leachate pH of 7.7, the laboratory added 70 mL of nitric acid to create a liquid pH of approximately 0.4. And, to achieve an AGREMAX pH of 6.7, the laboratory added 90 mL of nitric acid, with a resulting liquid pH of 0.3. These data are presented in the "Lab Extractions" sheet of the MS Excel file titled "AES_PR_1313 locked 121312.xlsx," which EPA provided via email on December 13, 2012.

leachate pH level.[16] We assume that (i) rain with a pH of 5.0, (ii) falls at a rate of 55 inches per year (which conservatively assumes the upper end of rainfall in the southern region where AGREMAX has been used) and that *all* rainfall infiltrates the surface and is in contact with AGREMAX[17]), (iii) on a 12-inch thick uncovered application of AGREMAX,[18] (iv) with an average dry bulk density of 1.0 g/cc.[19] Under these assumptions, it would take almost **55,000 years** to achieve a leachate pH of 8.6, which is the next-lowest leachate pH that Method 1313 produced below 10.9. Under these assumptions, it would take **76,000 years** to achieve a leachate pH of 7.7. And to achieve a leachate pH of 6.7—which EPA also considers in calculating its "indicator ratios"—some **98,000 years** of average rainfall would need to fall. In short, it is wholly unrealistic and misleading to compare the concentrations detected at pH levels lower than 10–11 to the reference concentrations.

<blockquote>
B.   EPA's mix-and-match approach to Method 1313 creates a composite for AGREMAX in Table 4 that does not and cannot exist in the real world
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Second, in Table 4, EPA has assembled a data set of the maximum concentration for each constituent detected in the 6.5-11.5 pH range. In so doing, the Report posits a chemical "fingerprint" of AGREMAX that does not and cannot exist in the real world. For example, where the maximum detected concentration of a constituent occurs at the bottom of EPA's pH range, the Report selects that concentration (e.g., boron) and includes it in Table 4. But where the maximum detected concentration of a constituent occurs near the upper end of the pH range, the Report selects that concentration (e.g., chromium) and includes that data in Table 4. Thus, each of these data points, which are based on widely divergent pH values, is combined into a

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[16] This analysis calculates how many "milliequivalents" of acid are required per square centimeter of surface area of AGREMAX to achieve a specified pH. By calculating the milliequivalents of acid per liter of rainfall, one can determine how many liters of rainfall applied over each square centimeter of AGREMAX are required to achieve a specified pH. As we know the annual rate of rainfall, we then can calculate how many years of such rainfall would need to fall to achieve the calculated number of liters of rainfall per square centimeter of AGREMAX. Together with this letter, we are submitting an MS Excel spreadsheet that contains these calculations.

[17] National Weather Service, Average Yearly Rainfall Maps, Mean Annual Precipitation 1981-2010, available at http://www.nws.noaa.gov/climate/local_data.php?wfo=sju. Assuming *all* the rainfall infiltrates the ground surface is likewise a very conservative assumption.

[18] If there were more AGREMAX in place, it would take even longer to reach the lower pH.

[19] Bulk density is a property of powders, granules and other "divided" solids, like soil or gravel. It is the mass of the particles of the material divided by the total volume they occupy. It is a way to express how dense a material may be to assess how much water may flow through it. The calculation above assumes an average dry bulk density of 1.0 g/cc, based on tests conducted on AGREMAX as used in road base and structural applications. *See* R. Carrasquillo & O. Antommettei, Testing and Condition Assessment Results, Projects with Agremax Subbase 16 (Jan. 2011) (reporting in-place dry densities ranging from 40.5 to 87.7 pounds per cubic foot, which is equivalent to 0.65 to 1.4 g/cc). This is a conservative assumption, as other tests of AGREMAX cited in Carrasquillo, *supra*, report higher bulk densities, which would result in even longer period of rainfall needed to achieve the lower pH levels.

single table and compared to EPA's reference criteria. This data set is not representative of AGREMAX in the real-world because this broad range of pH levels will never occur, certainly not simultaneously.

The Report's mix-and-match approach has the effect of greatly exaggerating the concentrations that could reasonably be expected in the real world. This cannot be disputed: "Many of the processes that result in the leaching of inorganic constituents ... are strongly pH-dependent." EPA, *Background Information for the Leaching Environmental Assessment Framework (LEAF)Test Methods* 7, EPA/600/R-10/170 (Nov. 2010). For example, boron was detected at a concentration of 1.13 to 1.15 mg/L at the pH of 10.9.[20] However, the Report includes in Table 4 the higher concentration of 12 mg/L found at a pH level of approximately 6.7—a leachate pH level that is well below the level reasonably expected under real world field conditions. The Report then compares the unrealistic 12 mg/L concentration to the equally inappropriate Drinking Water Equivalent Level ("DWEL") guidance value of 0.007 mg/L (as discussed below, the Report provides the incorrect DWEL: it is actually 7 mg/L) to arrive at an "indicator ratio" of 1,700, and thus receiving a "red box" in the Report's alarmist scheme. However, if one removes the effect of these errors, and uses a concentration of 1.13–1.15 mg/L, and then applies even EPA's RSL of 3.1 mg/L, one arrives at an "indicator ratio" of 0.37. In other words, the Report's method generates an "indicator ratio" that overstates the risk for boron *by a factor of over 4,500.*

EPA has claimed that Method 1313 is intended to be an improvement over the TCLP test because it was to provide the user a range of pH conditions that can then be applied to the appropriate site-specific application. In this case the data suggest that the appropriate pH for modeling leachate generation under field conditions is in the range of 10 to 11. Method 1313 was *not* intended to provide a range of concentrations from which the user would construct an artificial data set by arbitrarily selecting the highest available value for each constituent, without giving any consideration to the actual field conditions at issue.

V. The Report Distorts the Method 1314 Results by Selecting the Maximum Detected Concentrations Which Invariably Occur at the Lowest Liquid-to-Solid Ratios

The Report similarly skews its representation of the Method 1314 test results. Again, here, EPA has chosen the highest constituent concentration from the data, compiled those data in Table 4 of the Report, and compared those data to its chosen reference concentration. That approach is again wrong on multiple levels.

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[20] *See* Appendix B, at B-21 (Sample IDs 1313-AES-T03-A and 1313-AES-T03-B). Although Appendix B does not identify the samples by their respective pH levels, comparing Appendix B's results to the figures in Appendix A makes clear that sample T03 corresponds to the natural pH of 10.9.

First, the Report presents misleading information by not analyzing any site-specific data from the use of AGREMAX to identify applicable L/S ratios. As outlined above, the Report's authors who are the creators of the LEAF methods specifically warned that site-specific L/S ratios needed to be used when evaluating the LEAF test results or the analysis would be "misleading." *See* Kosson *et al.*, *supra*. Yet, that is precisely what EPA has failed to do in its Report. The Report displays the maximum concentration in Table 4 of the Report, without *any* attempt to determine the proper L/S ratio for evaluating whether metals would leach out of AGREMAX as it has been or would be placed in Puerto Rico.

Second, EPA selected the wrong data. If one were interested in comparing these laboratory test results to reference screening levels, the logical data points to compare would be those relevant to the exposure scenario about which EPA claims it is concerned—that AGREMAX will leach into ground water and humans will somehow be exposed *over time* by drawing their drinking water from that ground water. Thus, the risk is not that there will be one exposure, but exposure *over time*. Not only is this the concern EPA has expressed, but it is inherent in the fact that EPA has chosen extraordinarily low reference concentrations, such as the RSLs and DWELs, that are screening levels based on conservative assumptions about long-term, chronic exposure to a substance over time.[21]

Given that alleged concern about a long-term exposure scenario, EPA's own background document instructs that the data from the higher L/S ratios should be used, because those may better reflect the concentrations that would leach over time. According to EPA, the "*low* L/S concentrations provide insights into the composition of the *initial* pore solution," while the *higher* L/S concentrations "indicate the effects of *long-term* exposure." EPA 2010, *supra* at 8 (emphases added). EPA in fact accepts this premise in its Report. Report at 3 ("As it relates to conditions in the field, L/S can be considered a surrogate measure for time ....").

The Report did not, however, choose the data with the higher L/S ratios. Instead, a review of the data shows that invariably the Report has chosen the data from the *lowest* L-S ratios measured in the test—*i.e.*, the "initial" concentrations that would occur in the *short term* as water first comes into contact with AGREMAX. *See* Report at Appendix (graphs comparing concentrations of constituents to the L/S ratios used in Method 1314 test). Indeed, the data indicate that across all tested constituents, concentrations either decreased over time as the L/S ratio increased (reflecting an "initial" limited reservoir of available constituent with the remainder bound up in the matrix of the AGREMAX), *e.g.*, Report, Appendix A at A-2 (antimony, as an example) or stayed relatively constant (representing, we suspect, that equilibrium was quickly reached). *E.g.* Report, Appendix A at A-3 (beryllium, as an example). In no case did the concentration increase significantly as the L/S ratio increased. *See* Report,

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[21] EPA, Mid-Atlantic Risk-Assessment, Regional Screening Levels User Manual § 2.2, http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm.

Appendix A. As a result, for many constituents, the Report selects a concentration that would not be sustained in the long term and therefore has no relevance.

VI. The Report's Comparisons of Selected Data Points to Environmental Reference Concentrations Are Misleading

To illustrate the extent to which the Report mischaracterizes AGREMAX, we evaluate below each constituent EPA identified in the Report as having an "indicator ratio" above 10.[22] Moreover, we have prepared our own screening comparison (*see* attached Tables, Exhibits 1 & 2) following the same format EPA had used in its draft Report, but correcting both the environmental reference concentrations and the selected test results as follows:

- Reference concentrations. In preparing our own Tables, for the reasons discussed above, we do not use Region 2 Enforcement's "lowest available number" approach to set reference criteria but instead use an objective approach. Because the MCL is the legally enforceable standard for drinking water in Puerto Rico, we start with the MCL.[23] If no MCL exists, we use the RSL as providing an EPA screening reference criteria.[24] Finally, if neither an MCL nor an RSL is available for a particular constituent, we use the secondary MCL. However, the secondary MCL is not an enforceable standard and is set only to address aesthetic issues such as taste, color or odor. As EPA has stated, constituents present at the secondary MCL "are not considered to present a risk to human health." EPA, Secondary Drinking Water Regulations: Guidance for Nuisance Chemicals, 816-F-10-079, available at http://water.epa.gov/drink/contaminants/secondarystandards.cfm ("EPA does not enforce these 'secondary maximum contaminant levels' or 'SMCLs.' They are established only as guidelines to assist public water systems in managing their drinking water for aesthetic considerations, such as taste, color and odor.").

- Selected data. For our comparison, we also use data from the LEAF testing that more accurately reflect the real world conditions in which AGREMAX has been used. Accordingly, from Method 1313 we use the data from the testing with a pH of 10.9, and from Method 1314 we use data based on the highest L/S (the L/S of 10).

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[22] We use as our cutoff an "indicator ratio" of 10 only because EPA appears to attach a significance to that ratio in its Report. *See* Report at 11-12. As we note, *supra*, EPA has itself adopted generic dilution and attenuation factors as high as 100 in other contexts, and the Report offers no justification for using a factor of 10.

[23] We are not aware of evidence indicating that leachate from AGREMAX is percolating into groundwater, or that any constituents in such leachate would ever reach drinking water in concentrations of concern. Accordingly, MCLs are a conservative benchmark for evaluating the AGREMAX leachate.

[24] As outlined above, the RSL is only a screening tool and the presence of a constituent at or above the RSL does not mean that the concentration presents a risk to human health.

Using EPA's format with the corrected data, in each instance, the LEAF results confirm AES Puerto Rico's view that the placement of AGREMAX does not present a risk to human health.

To reiterate, however, we present these for comparison only. AES Puerto Rico does not agree that LEAF testing data should be used at all for the reasons outlined above.

A. Aluminum

For aluminum, EPA chose the secondary MCL (which is not risk-based) of 0.05 mg/L. As there is no MCL for aluminum, we use EPA's RSL, which is 16 mg/L, or 320 times higher than the secondary MCL. As reflected in the attached Tables, the concentration of aluminum detected using Method 1313 at the pH of 10.9 (0.35 mg/L) and using Method 1314 at the high L/S ratio (0.19 mg/L) fall well below the RSL. Indeed, even using the secondary MCL, the correct data would fall well within a reasonable attenuation, adsorption and dilution factor.

B. Arsenic

For arsenic, the EPA used the RSL of 0.000045 mg/L. That level is 200 times lower than the level allowed in drinking water across the United States, as the MCL is 0.010 mg/L. As reflected in the attached Tables, EPA detected arsenic at 0.0225 mg/L using Method 1313 at a pH of 10.9. Compared to the MCL, that equates to an EPA "indicator ratio" of approximately 2, which is well within the expected adsorption, attenuation, and dilution taking place in soil and ground water, resulting in theoretical exposure point concentrations below any level of concern. The concentration detected using Method 1314 at an L/S ratio of 10 (0.004 mg/L) falls well below the MCL.

C. Boron

As noted above, for boron, EPA chose the DWEL as its reference criteria, but mistakenly used 7 μg/L when in fact the DWEL for boron is 7 mg/L (which is *7,000 μg/L*). Thus, EPA should correct Table 1 of the Report to state 7,000 μg/L and Table 4 to state 7 mg/L, not .007 mg/L. As reflected in the attached Exhibits, using EPA's RSL as the screening criteria for boron of 3.1 mg/L, the concentrations using Method 1313 detected at a pH of 10.9 (1.1 mg/L) and using Method 1314 at the L/S ratio of 10 (0.46 mg/L) fall below the RSL screening level.

D. Chloride

For chloride, EPA purportedly applied an RSL of 1,600 μg/L as its reference criteria for chloride. *See* Report at Table 1. However, again, EPA made an error. EPA selected the RSL for *chlorine* in drinking water—not the *chloride* ion. There is, in fact, no RSL (or MCL) for *chloride* in water (i.e., salt water). In our Tables, we used the secondary MCL of 250,000 μg/L (or 250 mg/L). When compared to the secondary MCL, the concentration of chloride detected

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using Method 1313 at the pH of 10.9 (660 mg/L) is just 3 times this non-risk based screening level, and the chloride concentration detected using Method 1314 at the L/S ratio of 10 (7 mg/L) is below this level. Again, there is no reason to conclude these levels would present a risk to human health.

E.   Chromium

EPA collected chromium data, but compared those data to the RSL for hexavalent chromium (Cr (VI)) of 0.031 µg/L. *See* Report, Table 1. Chromium exists in two common oxidation states—trivalent chromium (Cr(III)) and hexavalent chromium (Cr(VI)). Chromium in trivalent form is an essential mineral found in certain foods, and can be bought over-the-counter as a vitamin supplement.[25] However, EPA chose to have its laboratory only test for total chromium and did not determine what portion of the material, if any, was hexavalent chromium. Thus, application of the *hexavalent* chromium RSL to *total* chromium data is clearly inappropriate.

Regardless, it is inappropriate to use the RSL for hexavalent chromium in this enforcement context, as the science underlying the RSL for hexavalent chromium has been called into question by EPA's own expert peer review panel, the agency's Science Advisory Board ("SAB"). EPA has not completed its own scientific review of whether ingesting hexavalent chromium may present a health risk, and if so at what levels and over what exposure period. Thus, the RSL is based on a toxicity value that was developed by one state agency—a toxicity value about which the SAB has since expressed serious reservations as not being based on sound science.[26]

Moreover, public water systems across the United States only test for and are only subject to the MCL for chromium. Using the MCL for chromium of 0.1 mg/L, the concentrations of total chromium in leachate detected using Method 1313 at a pH of 10.9 (0.015 mg/L) and using Method 1314 at an L/S ratio of 10 (0.0018 mg/L) fall well below the MCL—or 7-55 times lower than would be allowed in drinking water anywhere in the United States.

F.   Fluoride

For fluoride, EPA uses the RSL of 0.62 mg/L, which is six times more stringent than the MCL. The Report's maximum-detect approach used a concentration of 40 mg/L, which corresponds to a pH level of approximately 6.7—substantially below the expected pH under real

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[25] http://www.webmd.com/vitamins-and-supplements/lifestyle-guide-11/supplement-guide-chromium http://www.nlm.nih.gov/medlineplus/ency/article/002418.htm ("Chromium is an essential mineral that is not made by the body and must be obtained from the diet").

[26] The SAB review can be accessed at http://cfpub.epa.gov/ncea/iris_drafts/recordisplay.cfm?deid=221433.

world field conditions. Here, the concentrations detected using Method 1313 at the pH of 10.9 (7.2 mg/L) are only slightly above the MCL of 4.0 mg/L (an EPA "indicator ratio" of only 2) and well within a reasonable adsorption, attenuation and dilution factor. Using Method 1314 at the L/S ratio of 10, the result (2.6 mg/L) falls well below the MCL.

G. Lithium

For lithium, like EPA, we use the RSL of 0.031 mg/L. However, lithium presents another instance in which selecting the highest detected concentrations under Methods 1313 and 1314 is unrealistic because they occur at a pH of 6.7 and at the lowest L/S ratio. The concentrations of lithium detected using Method 1313 at the pH of 10.9 (0.28 mg/L) and using Method 1314 at the L/S ratio of 10 (0.2 mg/L) are each above the RSL, but well within any reasonable adsorption, attenuation, and dilution factor.

H. Molybdenum

Molybdenum presents another instance in which selecting the highest detected concentrations distorts the results because they occur at a pH of 6.7 for Method 1313 and at the lowest L/S ratio for Method 1314. Indeed, the Method 1314 results are a good example of how a limited volume of certain constituents may leach from the surface in the "initial" solution collected in the test, while the rest of the material is bound up and does not leach *over time*. The leachate concentrations decrease dramatically in EPA's testing from 12.8 mg/L at an L/S ratio of 0.2 to more than 120 times lower or only 0.1 mg/L at an L/S ratio of 2 and even lower as the L/S ratio increases.

For molybdenum, like EPA, in our Tables we use the RSL of 0.078 mg/L as the screening reference criteria. The concentration of molybdenum detected using Method 1313 at the pH of 10.9 (0.65 mg/L) and using Method 1314 at the L/S ratio of 10 (0.028 mg/L) either fall below the screening level or would have an EPA "indicator ratio" of approximately 8, and thus fall well within any reasonable adsorption, attenuation, and dilution factor.

I. Selenium

For selenium, the Report selects the MCL (0.05 mg/L) over the RSL, apparently because the RSL for selenium is less stringent than the MCL. But selenium presents yet another instance in which by selecting the highest detected concentrations, EPA has distorted the results because they occur at a pH of 6.7 for Method 1313 and at the lowest L/S ratio for Method 1314. The concentration of selenium detected using Method 1313 at the pH of 10.9 (0.2 mg/L)and using Method 1314 at the L/S ratio of 10 (0.0092 mg/L) again either fall below the Region's screening level or well within any reasonable adsorption, attenuation, and dilution factor before reaching any theoretical receptor.

J. Sulfate

For sulfate, like EPA, we used the secondary MCL (250 mg/L) as a screening tool, because there is no MCL or RSL for sulfate. However, exceedances are not a human health risk, as the screening level is based on aesthetic, not risk, criteria.

Here, by selecting the highest detected concentration of sulfate under Method 1314 once again EPA has distorted the results because it occurs at the lowest L/S ratio (21,000 mg/L). The more appropriate selection of the concentration detected using Method 1314 at the L/S ratio of 10 (1,600 mg/L) has an EPA "indicator value" of just 6, well below any reasonable estimate of the effect of dilution and attenuation. For Method 1313, the sulfate concentrations are relatively constant across pH values of 6.5 to 11.5, and thus this is the only constituent whose concentration (2,700 mg/L) results in an EPA "indicator ratio" of greater than 10—here, 11—but still well below the dilution-attenuation values that EPA itself has used in other contexts.

K. Thallium

For thallium, EPA used the RSL (0.00016 mg/L) which is more than 12 times lower than the MCL (0.002 mg/L). This selection is especially questionable because the RSL for thallium is based solely upon one short-term study involving an end point (atrophy of hair follicles in rats) that was not toxic *per se* and that EPA did not deem sufficient to develop a provisional peer reviewed toxicity value. *See* EPA, Regional Screening Level (RSL) Tapwater Supporting Table. Regardless, using Methods 1313 and 1314 at a pH of 10.9 and an L/S of 10, thallium was not even detected.

* * *

Should you have any questions regarding this letter, please contact me.

Sincerely,

Samuel B. Boxerman

Attachments

cc: George Meyer
    Leonard Grossman
    William Sawyer
    David Buente
    Matthew Krueger
    Sylvia Lowrance

Years of Rainfall Required to Reduce Leachate pH of AGREMAX Material to a pH of 8.6

Inputs

Acid equivalents required to achieve pH 8.6	2.5	meq/g	(a)
Annual rainfall	55	in	(b)
		139.7 cm	Calculated value
Rainfall pH	5		(b)
Acid equivalents		0.01 meq/L	Calculated value
Thickness of AGREMAX application	12	in	Assumed value
		30.48 cm	Calculated value
Assumed bulk density of AGREMAX	1	g/cm3	(d)

Results

Net infiltration of rainfall required to achieve desired pH	3000000 inches
Time required to achieve desired pH	54,545 years

(a) Source: EPA LeachXSTM spreadsheet ("AES_PR_1313 locked 121312.xlsx") (Lab Extractions Tab)

(b) Assumes 100% net infiltration. Source: National Weather Service, Average Yearly Rainfall Maps, Mean Annual Precipitation 1981-2010

(c) Sources: E.Osborne, Engineering Research Center, University of Puerto Rico, Acid Rain in Puerto Rico, Final Technical Report to the US Dept of the Interior (1986); National Atmospheric Deposition Program data, available at http://nadp.sws.uiuc.edu

(d) Source: R. Carrasquillo & O. Antommettei, Testing and Condition Assessment Results, Projects with Agremax Subbase (Jan. 2011)

JANUARY 10, 2013

Years of Rainfall Rquired to Reduce Leachate pH of AGREMAX Material to a pH of 7.7

Input

Acid equivalents required to achieve 7.7 pH	3.5	meq/g	(a)
Annual rainfall	55	in	(b)
		139.7 cm	Calculated value
Rainfall pH	5		(b)
Acid equivalents		0.01 meq/L	Calculated value
Thickness of AGREMAX application	12	in	Assumed value
		30.48 cm	Calculated value
Assumed bulk density of AGREMAX	1	g/cm3	(d)

Results

Net infiltration of rainfall required to achieve desired pH	4200000 inches
Time required to achieve desired pH	76,364 years

(a) Source: EPA LeachXSTM spreadsheet ("AES_PR_1313 locked 121312.xlsx") (Lab Extractions Tab)

(b) Assumes 100% net infiltration. Source: National Weather Service, Average Yearly Rainfall Maps, Mean Annual Precipitation 1981-2010

(c) Sources: E.Osborne, Engineering Research Center, University of Puerto Rico, Acid Rain in Puerto Rico, Final Technical Report to the US Dept of the Interior (1986); National Atmospheric Deposition Program data, available at http://nadp.sws.uiuc.edu

(d) Source: R. Carrasquillo & O. Antommettei, Testing and Condition Assessment Results, Projects with Agremax Subbase (Jan. 2011)

JANUARY 10, 2013

Years of Rainfall Required to Reduce Leachate pH of AGREMAX Material to a pH of 6.7

Inputs

Acid equivalents required to achieve pH 6.7	4.5	meq/g	(a)
Annual rainfall	55	in	(b)
		139.7 cm	Calculated value
Rainfall pH	5		(b)
Acid equivalents		0.01 meq/L	Calculated value
Thickness of AGREMAX application	12	in	Assumed value
		30.48 cm	Calculated value
Assumed bulk density of AGREMAX	1	g/cm3	(d)

Results

Net infiltration of rainfall required to achieve desired pH	5400000 inches
Time required to achieve desired pH	98,182 years

(a) Source: EPA LeachXSTM spreadsheet ("AES_PR_1313 locked 121312.xlsx") (Lab Extractions Tab)

(b) Assumes 100% net infiltration. Source: National Weather Service, Average Yearly Rainfall Maps, Mean Annual Precipitation 1981-2010

(c) Sources: E.Osborne, Engineering Research Center, University of Puerto Rico, Acid Rain in Puerto Rico, Final Technical Report to the US Dept of the Interior (1986); National Atmospheric Deposition Program data, available at http://nadp.sws.uiuc.edu

(d) Source: R. Carrasquillo & O. Antommettei, Testing and Condition Assessment Results, Projects with Agremax Subbase (Jan. 2011)

JANUARY 10, 2013

EXHIBIT 1.   CORRECTED PRESENTATION OF LEAF METHOD 1313 RESULTS

Corrected Presentation of LEAF Method 1313 Results

Analyte	Symbol	Environmental Refrence Conc. (mg/L)	Source of ERC (a)	Maximum M1313 natural pH (mg/L)	M1313 Indicator Ratio (unitless)
Aluminum	Al	16	RSL (b)	0.35	- (f)
Antimony	Sb	0.006	MCL (c)	0.012	2
Arsenic	As	0.01	MCL	0.022	2
Barium	Ba	2	MCL	0.069	-
Beryllium	Be	0.004	MCL	ND (g)	-
Boron	B	3.1	RSL	1.1	-
Cadmium	Cd	0.005	MCL	0.00077	-
Chloride	Cl	250	SMCL (d)	660	3
Chromium	Cr	0.1	MCL	0.015	-
Cobalt	Co	0.0047	RSL	ND	-
Copper	Cu	0.62	RSL	ND	-
Fluoride	F	4	MCL	7.2	2
Iron	Fe	11	RSL	ND	-
Lead	Pb	0.015	MCL	ND	-
Lithium	Li	0.031	RSL	0.28	9
Manganese	Mn	0.32	RSL	0.0099	-
Molybdenum	Mo	0.078	RSL	0.65	8
Nickel	Ni	0.3	RSL	ND	-
Nitrate	NO_3	10	MCL	41	4
Nitrite	NO_2	1	MCL	ND	-
Phosphate	PO_4	760	RSL (e)	ND	-
Selenium	Se	0.05	MCL	0.2	4
Strontium	Sr	9.3	RSL	8.7	1
Sulfate	SO_4	250	SMCL	2700	11
Thallium	Tl	0.002	MCL	ND	-
Tin	Sn	9.3	RSL	ND	-
Uranium	U	0.03	MCL	ND	-
Vanadium	V	0.078	RSL	0.16	2
Zinc	Zn	4.7	RSL	ND	-

Notes		
	(a)	Heirarchy of environmental reference concentrations is MCL > RSL > SMCL
	(b)	USEPA risk-based Regional Screening Level for Tapwater
	(c)	USEPA Maximum Contaminant Level for drinking water
	(d)	USEPA Secondary Maximum Contaminant Level (based on aaesthetic considerations such as taste, color, odor)
	(e)	Value reported is for phosphoric acid
	(f)	"-" indicates M1313 Indicator ratio is less than 1.0 (i.e leachate concentration is less than ERC)
	(g)	ND - not detected

EXHIBIT 2.   CORRECTED PRESENTATION OF LEAF METHOD 1314 RESULTS

FOR SETTLEMENT ONLY

Corrected Presentation of LEAF Method 1314 Results

Analyte	Symbol	Environmental Refrence Conc. (mg/L)	Source of ERC (a)	M1314 Concentration at L/S = 10 (mg/L)	M1314 Indicator Ratio (unitless)
Aluminum	Al	16	RSL (b)	0.19	- (f)
Antimony	Sb	0.006	MCL (c)	ND (g)	-
Arsenic	As	0.01	MCL	0.0044	-
Barium	Ba	2	MCL	0.032	-
Beryllium	Be	0.004	MCL	ND	-
Boron	B	3.1	RSL	0.46	-
Cadmium	Cd	0.005	MCL	ND	-
Chloride	Cl	250	SMCL (d)	7	-
Chromium	Cr	0.1	MCL	0.0018	-
Cobalt	Co	0.0047	RSL	ND	-
Copper	Cu	0.62	RSL	ND	-
Fluoride	F	4	MCL	2.6	-
Iron	Fe	11	RSL	ND	-
Lead	Pb	0.015	MCL	ND	-
Lithium	Li	0.031	RSL	0.2	6
Manganese	Mn	0.32	RSL	ND	-
Molybdenum	Mo	0.078	RSL	0.028	-
Nickel	Ni	0.3	RSL	ND	-
Nitrate	NO_3	10	MCL	1.2	-
Nitrite	NO_2	1	MCL	ND	-
Phosphate	PO_4	760	RSL (e)	ND	-
Selenium	Se	0.05	MCL	0.0092	-
Strontium	Sr	9.3	RSL	8.8	-
Sulfate	SO_4	250	SMCL	1600	6
Thallium	Tl	0.002	MCL	ND	-
Tin	Sn	9.3	RSL	ND	-
Uranium	U	0.03	MCL	ND	-
Vanadium	V	0.078	RSL	0.12	2
Zinc	Zn	4.7	RSL	0.0065	-

Notes		
	(a)	Heirarchy of environmental reference concentrationsis MCL > RSL > SMCL
	(b)	USEPA risk-based Regional Screening Level for Tapwater
	(c)	USEPA Maximum Contaminant Level for drinking water
	(d)	USEPA Secondary Maximum Contaminant Level (based on aesthetic considerations such as taste, color, odor)
	(e)	Value reported is for phosphoric acid
	(f)	"-" indicates M1314 Indicator ratio is less than 1.0 (i.e leachate concentration is less than ERC)
	(g)	ND - not detected